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MEMORANDUM

To: T.C. Greengard
From: B.P. Doty

1801-03
April 22, 1988

Subject: Recommendations for Phase II RI
903 Pad, Mound and East Trenches

This memorandum presents recommendations for further investigations at the 903 Pad, Mound and East Trenches areas at the plant. The memo begins with a review of the SWMUs as a vehicle for showing the present level of knowledge and the rationale for additional investigative effort.

903 PAD AREA

SWMU 109. Trench T-2

Prior to 1968, the trench was used for disposal of sanitary sewage sludge and flattened drums contaminated with uranium and plutonium. Metal (presumed to be flattened drums) is currently present in the trench based on visual observation of lids at the surface and a metal detector survey. The trench is approximately 5 feet deep, 15 feet wide and 200 feet long.

Soils consist of both clayey and gravelly colluvium. Bedrock is apparently claystone immediately beneath the colluvium. Colluvium is apparently dry.

Soil gas concentrations of PCE and TCE downslope of the trench are either derived from the trench or conceivably from SWMU 112. PCE and TCE are the primary VOCs detected in soil samples. Both are quite high in bedrock immediately beneath the contact (3,800 and 16,000 ug/kg, respectively) and there appears to be some evidence that concentrations decrease deeper in the bedrock. Phthalate concentrations appear to decrease with depth, even in the colluvium.

Plutonium/radiometric profiling.

ADMIN RECORD

A-DU02-000630

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SWMU 112. 903 Pad

The 903 pad covers the area used between 1958 and 1967 for storage of drums containing uranium and plutonium contaminated used machine cutting oil and other fluids. Generally the drums contained lathe coolant consisting of mineral oil(?) and carbon tetrachloride, although some of the drums contained hydraulic oil, vacuum pump oil, TCE, PCE, silicone oil and acetone. Ethanalamine was added to the drums after 1959 to reduce corrosion (apparently a significant number of the drums corroded during the first year of use of the area).

A remedial action was undertaken at the drum storage area in the period 1967 through November 1969. All drums were removed and plutonium contaminated soils were consolidated in a smaller area, covered with soil and capped with asphalt concrete.

Prior to the 1967-1969 remedial action, an estimated 5,000 gallons of liquid containing 86 grams of plutonium were released (no estimate of uranium). This volume does not come close to filling the available pore volume beneath the pad (200 feet by 200 feet in plan and 20 feet thick with a porosity of approximately 30% -- a pore volume of about 7,000,000 gallons). Even using a retention factor of 0.8% following CONCAWE (1981) for oils in gravel and coarse sand provides a significant excess soil retention volume (200,000 gallons). Based on these calculations, all of the oils should be retained in the soils and there should not be a release to ground water. Because there is such a release, it seems likely that considerably more drums disintegrated than the 100 implied by the estimated release of 5,000 gallons (about 10 drums per year).

Soil gas (especially PCE) was found to be elevated east of the pad; however, counts were not as high as elsewhere in the Area. It should be noted that the presence of subcropping sandstone which dips under claystone could significantly impact the soil gas survey in the vicinity of the SWMU (i.e., soil gas counts can be expected to be lower over areas underlain by claystone while concentrations in the sandstone bedrock ground water could be significant).

Soils are either not contaminated with VOCs (based on laboratory results) or the borings did not penetrate soils underlying the SWMU. The latter is probably the case. Phthalates are present in the soils.

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Radiometric profiling is required in at least one boring to showing that plutonium contamination of soil is restricted to the surface and is the result of wind dispersal.

SWMU 140. Reactive Metal Destruction Site

During the 1950's and 1960's, this area was used for destruction of reactive metals (mostly lithium, but also sodium, calcium and magnesium). Residues were buried on-site. In addition, "some" solvents were also destroyed at this location.

The colluvium underlying the site is sandy or gravelly and may or may not be saturated. Bedrock immediately beneath colluvium consists of both claystone and sandstone.

Soil gas contains very high TCE (trichloroethene) and PCE (tetrachlorethene) concentrations, possibly associated with SWMU 140 or SWMU 109 or conceivably associated with SWMU 112 via a bedrock ground-water flow path. TCE was found at estimated concentrations in soil samples from the two SWMU-centered borings (BH27- and BH28-87) and PCE was found at a fairly high concentration in BH28-87 near the base of the colluvium (210 ug/kg). Carbon tetrachloride was found at concentrations increasing with depth in the colluvium and then at a reduced concentration in bedrock in BH28-87. Phthalates were also found in the soils.

Plutonium profiling.

SWMU 155. 903 Pad Lip Area

This area is located south and east of the 903 pad and is contaminated with radionuclides via wind transport. Based on boring and soil gas data, it does not appear to contain organically-contaminated soil. The nature of the radiometric contamination and the vertical and horizontal extent of contamination are not defined.

SWMU 183. Gas Detoxification Site

Gases were detoxified using an unspecified commercial neutralization process. The gas bottles were triple-rinsed, crushed and placed in the present landfill. No mention is made of residuals or wastes from the neutralization process, disposition of rinsate or where the bottles were crushed. The

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site will be investigated later in support of the development of a RCRA closure plan.

903 Area Ground Water

to be completed.

MOUND AREA

SWMU 108. Trench T-1

Trench T-1 was used between 1952 and 1962 for disposal of drums containing depleted uranium chips coated with lathe coolant. The trench is believed to contain approximately 125 drums. The trench is approximately 15 feet wide, 200 feet long and five feet deep. The drums are covered with about 2 feet of soil, although two drums were uncovered during weed cutting in 1982. One of the drums was sampled and found to contain an oily sludge with 4.3 picoCuries per gram (pCi/g) plutonium and 1.2 microcuries per gram uranium.

The site is underlain by Rocky Flats Alluvium to a depth of 15.6 feet. The alluvium is stratified, with sand to four feet underlain by a clayey sand and then a gravel. The need for vertically discrete sampling should be evaluated (no water in shallow sand is the answer). The alluvium is underlain by sandstone immediately west of the SWMU. Water occurs in both the alluvium and bedrock.

PCE is elevated in soil gas in the area (particularly north of the trench) and TCE is not elevated. The northern shift of the PCE elevation is probably due to ground-water flow in that direction. It is not due to SWMU location uncertainty as the SWMU is well marked in the field. Analysis of soil samples indicates that the soils may contain acetone and phthalate. It is not clear why PCE is not found in the soils -- did we miss it or does the PCE in the soil gas emanate from some other source? The Phase I RI suggests that SWMU 113 may be the source -- this should be confirmed.

Radiometric profiling.

SWMU 113. Mound Area

The mound area was used during an unspecified period for storage of approximately 1400 drums containing depleted

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uranium and beryllium wastes. In addition, the drums contained some lathe coolant and possibly a solvent known as Perclene which is believed to be PCE. In 1970, the area was cleaned-up and the material shipped off-site to another DOE facility as radioactive waste. After the clean-up, surficial soil sampling found alpha activity in the range of 0.8 to 112.5 disintegrations per minute per gram of soil. This activity was believed to result from wind dispersal of 903 pad materials. This should be confirmed with radiometric depth profiling.

Why is it called the Mound?

Minor amounts of TCE but major amounts of PCE were found in soil gas in the vicinity of the mound. PCE was also found in soil gas east and especially north of the mound. Analysis of soil samples did not detect significant concentrations of VOCs in the soil. This anomaly must be explained. Is it sampling protocol? If not, what is the source of the PCE in soil gas?

SWMU 153. Oil Burn Pit No. 2

The oil burn pit consisted of two parallel trenches that were used in 1957 and from 1961 to 1965 to burn 1,083 drums of oil containing uranium. Residues and some flattened drums were covered with backfill. The site was cleaned-up in the 1970s; the clean-up involved excavation to five feet below ground.

PCE is definitely elevated in soil gas in the vicinity of the SWMU. Soil samples contained acetone. Why do the soils not contain PCE and what is its source? Did we drill in the right place, knowing what we know now?

Radiometric profiling.

SWMU 154. Pallet Burn Site

Little is known about activities at this site. Apparently, pallets were burned here in 1965 and the site was cleaned-up in the 1970s.

Although the site is written-off in the RI, the PCE in soil gas in the area must be explained.

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Mound Area Ground Water

Data are lacking to evaluate ground-water contamination in the vicinity. Three new alluvial wells were built in 1986-87 and data are presented for only one (43-86, upgradient, no VOCs). Well 1-74 continues to show TCE and PCE in 100s ug/l. The downgradient alluvial well (35-86, in South Walnut Creek drainage) has vinyl chloride in the 100s and trans, 1-2 DCE in the 100s to 1000s ug/l. Because the constituents are completely different, the 35-86 contamination is from a different source. Although data are not complete, three of the four bedrock wells show no VOCs.

EAST TRENCHES

SWMU 110. Trench T-3 & SWMU 111. Trenches T-4 through T-11

The east trenches were used from 1954 to 1968 for disposal of depleted uranium, flattened depleted uranium and plutonium contaminated drums and sanitary sewage sludge. The trenches are approximately 50 feet wide and 300 feet long (depth is unknown). SWMU 110 (T-3) received radioactively contaminated drums and substantial sludge volume. SWMU 111 (T-4 through T-11) had radioactivity (surface?) ranging from 800 to 8,000 dpm/g. SWMU 111 (unspecified trenches) also received planks from the solar ponds and sewage treatment plant sludge. The trenches are covered with soil.

Soil gas shows high PCE apparently emanating from the western cluster of trenches and extending to the north and possibly east. The eastern cluster does not have a significant spatially associated soil gas plume. VOCs were not significantly detected in soils adjacent to the western group of trenches; acetone may be present in the soils adjacent to the eastern group of trenches. Did we miss the soil contamination by drilling adjacent to the trenches?

Radiometric profiling is required in at least one boring to show that plutonium contamination is a surface phenomenon and, therefore, probably related to wind dispersal from the 903 pad (SWMU 112).

The east trenches can be spatially differentiated, a group to the west and a group to the east.

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The western group is founded on relatively homogeneous Rocky Flats Alluvium, approximately 25 feet thick, although the area is crossed by a buried ravine. Depth to water in the alluvium is approximately 15 feet. Bedrock beneath this group includes subcropping sandstones.

The eastern group is founded on stratified Rocky Flats Alluvium that varies in thickness from about 12 to 45 feet. The uppermost alluvium appears fairly permeable as does the bottom of the alluvium. There appears to be a thick clayey zone between these that could cause an hydraulic separation. Generally it appears that the upper permeable zone is not saturated. If we feel comfortable with this, then we need not investigate the alluvium as a layered system. Otherwise, let us drill a shallow well adjacent to 32-87 to prove it. Although not shown on the potentiometric surface map, it seems clear that the top of bedrock rises above the potentiometric surface and that much of the thin alluvium beneath the eastern group is dry. Bedrock appears to be claystone.

Ground-water contamination is apparently limited to volatile organics.

Of the 8 1986-87 alluvial wells in the area, only three have volatile data reported. What does this mean? 42-86 (apparently side-gradient from the western group of trenches) has carbon tetrachloride plus TCE and PCE (mound is source?). The other wells (32-87 and 41-86) are downgradient of the eastern trenches and contain traces of TCE but quantifiable amounts of PCE (is PCE a signature of the trenches?). We need the data for the other wells which should then be contoured. A plume delineation program can then be devised.

Bedrock ground water may be contaminated with carbon tetrachloride, TCE and PCE -- particularly at the upgradient bedrock well 25-87BR (mound is source?). Well 40-86BR may contain PCE. Additional sampling is required to evaluate the presence of bedrock contamination due to the east trenches.

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RECOMMENDATIONS

At least the following recommendations for further work are made in the text of the RI, specifically,

1. Additional K testing of Rocky Flats Alluvium,
2. Further investigation of the continuity of bedrock sandstones, and
3. Additional radiometric data are required before non-contamination with radionuclides can be firmly concluded.

These certainly appear appropriate.

In addition, I recommend the following.

1. Perform vertical radiometric profiling at all sites to prove that radiometric contamination is a surficial phenomenon and hence the result of wind dispersal from the 903 pad area. Samples should be composites of one foot lengths (depths) or less. At least one profile per SWMU. Samples should be sieved for comparison with soil screening/washing treatment technology.
2. Soil contamination at SWMU 112 (903 pad) is not adequately characterized. Are there organics in the soil? If we excavate, how deep (for both rads and organics)?
3. Additional alluvial and bedrock water quality data are needed to evaluate the nature and extent of ground-water contamination at the Mound Area. Additional drilling should not begin until they are evaluated.
4. Additional sampling is required to evaluate the presence of bedrock contamination due to the east trenches.

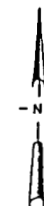
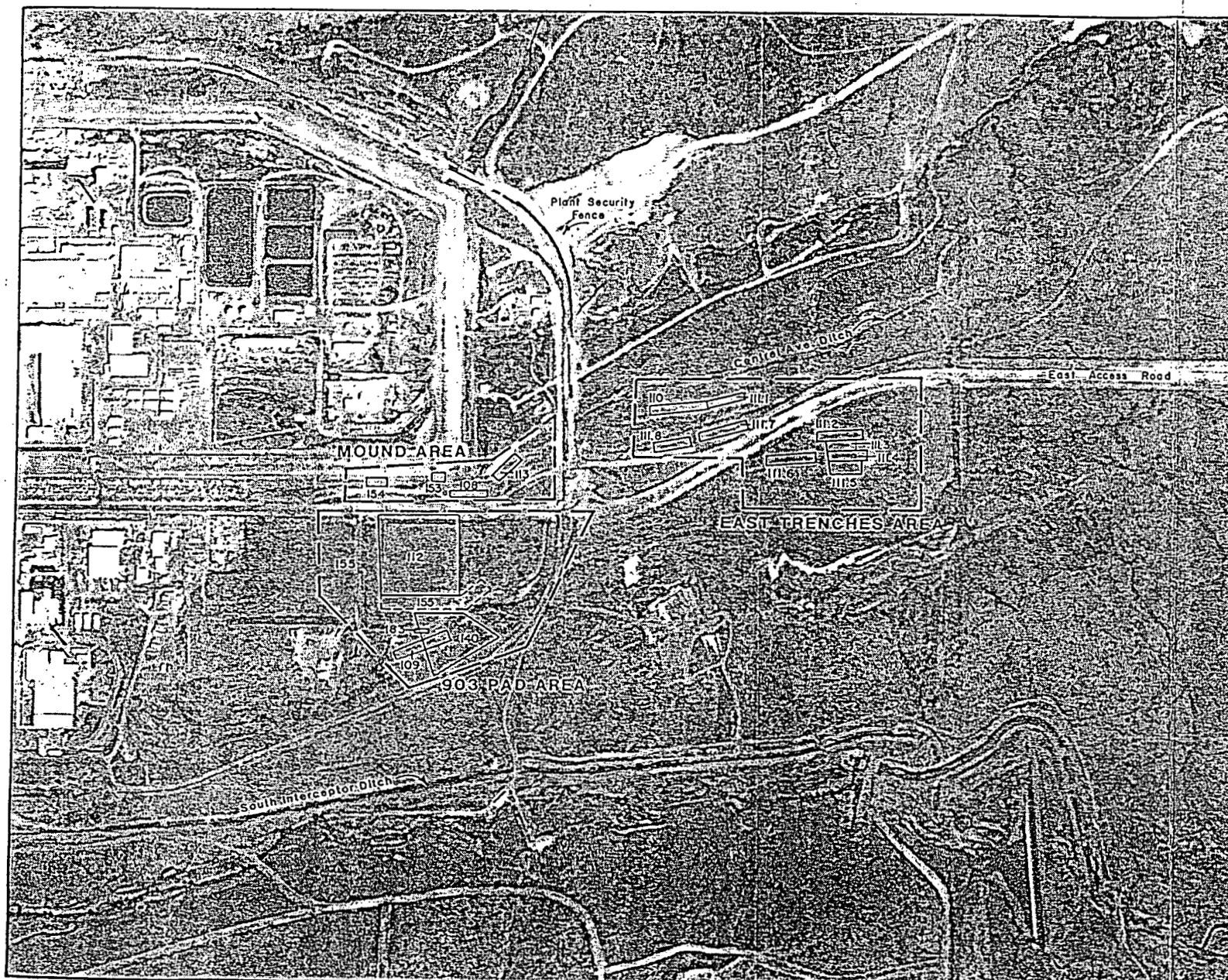
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5. We need the data for the other wells at the east trenches to see how much we currently know about the extent of contamination of the alluvium. A plume delineation program can then be devised.

A shallow well could be installed adjacent to 32-87 to investigate stratification in the alluvium.

Finally, I recommend that we use the work plan being prepared for Phase II as the vehicle for presenting the additional data. In addition, I highly recommend that several cartoons be prepared to illustrate our 3-dimensional understanding of the flow system.



EXPLANATION:

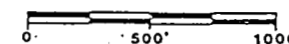
- Location of Solid Waste Management Unit
- Location of Areas of Interest Within Solid Waste Management Unit
- 101 Solid Waste Management Unit Reference Number (Rockwell International, 1986a)

NOTES:

- 1) Base map photo-enlarged from aerial photography of Rocky Flats Plant taken May 20, 1986.
- 2) The locations of the solid waste management units have been located as accurately as possible, based on information available prior to 1987 remedial investigation.

Modifications to these locations as a result of on-going studies and future site characterization will be made as required.

1"=500'



**Figure 2-3:
Remedial Investigation
Area Locations and
Associated Solid Waste
Management Units**

December 31, 1987